



Anesthesia Management for Transcatheter Atrial Septal Defect Closure in Pediatric Patients

Pediyatrik Hastalarda Transkateter Atriyal Septal Defekt Kapatılmasında Anestezi Yönetimi

Anesthesia for Pediatric Atrial Septal Defect

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Özet

Amaç: Atriyal septal defektin cerrahi tedavisinin kesin sonuçları olsa da, girişimsel teknolojilerdeki gelişmeler transkateter atriyal septal kapama işlemini cerrahiye alternatif güvenli ve uygulanabilir bir yöntem haline getirmiştir. **Gereç ve Yöntem:** Bu çalışmadaki amacımız genel anestezi altında, transözefageal ekokardiyografi eşliğinde gerçekleştirilen transkateter kapatma işlemi yapılan atriyal septal defektli pediyatrik hastalardaki anestezi yönetimini tartışmaktır. **Bulgular:** Transkateter atriyal septal defekt kapatılması işlemi yapılan 25 hastanın bilgileri retrospektif olarak toplandı. Hastaların yaş ortalamaları $8,66 \pm 3,34$ idi. Tüm işlemler genel anestezi altında transözefageal ekokardiyografi kılavuzluğunda gerçekleştirildi. Anestezi ve işlem ile ilişkili her hangi bir major komplikasyon ile karşılaşılmadı. İki hastada geçici bradikardi görüldü ve atropin ile tedavi edildi. **Tartışma:** Pediyatrik kardiyak kateterizasyon işlemleri için ideal anestezi yöntemi ve ilaç kombinasyonu halen tartışmalıdır. İster genel anestezi isterse de derin sedasyon uygulansın, kullanılan ilaçların hemodinamik etkileri çok iyi bilinmelidir. Anestezist muhtemel komplikasyonlara karşı önlem almalı ve hastanın hemodinamisini yakından takip etmelidir.

Anahtar Kelimeler

Pediyatri; Anestezi; Atriyal Septal Defekt

Abstract

Aim: Surgical treatment of the atrial septal defect has curative results, but improvements in interventional technologies have made transcatheter atrial septal defects closure procedure a feasible and safe alternative to surgery. **Material and Method:** We aimed to investigate the anesthetic management of percutaneous closure of atrial septal defects under transesophageal echocardiography guidance in pediatric patients. **Results:** A retrospective review of the anesthetic data of 25 patients who underwent transcatheter closure of atrial septal defects was conducted. The mean age 8.66 ± 3.34 years. All procedures were performed under general anesthesia with the guidance of transesophageal echocardiography. We did not encounter any major complication related to the procedure or anesthesia. Transient bradycardia occurred in two patients, which was treated with atropine. **Discussion:** An ideal anesthesia method and anesthetic drug combination for pediatric cardiac catheterization procedures is still controversial. Whether general anesthesia or deep sedation is preferred, the hemodynamic effects of the drugs used are known very well. The anesthesiologist should take precautions against possible complications and the patient's hemodynamic stability must be closely followed.

Keywords

Pediatrics; Anesthesia; Atrial Septal Defect

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Introduction

Improved diagnostic imaging technology has made it easier to identify patients with congenital heart diseases (CHD). Atrial septal defect (ASD) is one of the commonest CHD in childhood. Although surgical treatment of these anomalies have curative results, considerable improvements in interventional technologies have made percutaneous closure of defects with left-to-right cardiac shunts a feasible and safe alternative to surgery. Especially in secundum ASD, percutaneous closure is widely employed in appropriate patients as it is minimally invasive[1]. Transcatheter ASD closure is preferred in most cases because of shorter hospital stay, no need for sternotomy, better cosmetic results and lesser postoperative pain, morbidity and cost[2,3]. Most centers carry out the transcatheter ASD closure under general anesthesia as the patient must remain immobile with stable hemodynamics during the process. In addition, transesophageal echocardiography (TEE) is an essential part of the process during both evaluation of the defect and placement of the device, thus general anesthesia may be considered. However, some authors raised concerns over general anesthesia as it might negatively affect the outcomes and increase complications, advocating the use of deep sedation with spontaneous breathing for the interventional procedure and continuous TEE monitoring[4].

The aim of this study was to present our anesthesia management in transcatheter ASD closure procedure and evaluate the results in the pediatric age group.

Material and Method

The data from 25 pediatric patients who underwent percutaneous ASD closure procedure since 2009 until 2014 were collected retrospectively and included in the study. Both anesthesia management and interventional procedures were applied by the same anesthesiologist and pediatric cardiologist in each case. All patients were informed about the process by the pediatric cardiologist before the procedure and preanesthetic assessment was made one to two days before the procedure by a senior anesthesiologist. Written informed consents were obtained from the parents of each patient.

Following a fasting period appropriate for the age of the patient, vascular access was established and patients were premedicated with intravenous 0.1 mg/kg midazolam 5 minutes before transferring to the pediatric cardiac catheterization laboratory as a standard clinical procedure of our institute. Standard monitoring was applied to all patients including 5-lead electrocardiogram (ECG), noninvasive blood pressure and pulse oximetry, associated later with invasive pressure monitoring after the placement of femoral catheter sheaths. General anesthesia was performed with IV anesthetics and neuromuscular blocking agents. After adequate neuromuscular blockade was achieved, intubation was performed with an endotracheal tube of appropriate size. Then, TEE was placed to assess the ASD size and the device position during the procedure. It was also used to define the relationship between the ASD and surrounding structures. Maintenance fluid was infused and anesthesia maintained with 1-2% sevoflurane in air-oxygen mixture (FiO₂:0.4). The patients were warmed with an air blanket. During the whole procedure, ECG, both invasive and non-invasive blood pressure, peripheral

oxygen saturation, capnography and body temperature were continuously monitored. Local anesthetic infiltration was performed with prilocaine (2 ml prilocaine diluted into 10 ml, 2-3 ml for each application) into femoral puncture sites for preoperative analgesia which is routinely using in the anesthesia practice for reducing perioperative analgesic consumption. Heparin (100 U/kg) was administered to prevent thrombus formation after achievement of vascular access and additional doses given as required. Antibiotic prophylaxis was applied preoperatively. Paracetamol 10 mg/kg (IV) was administered to all patients for postoperative analgesia. At the end of the procedure, all patients were extubated and transferred to the cardiac intensive care unit to be observed for 24 hours.

All data were processed using SPSS 15.0 version for Window. All data were expressed as mean, standard deviation (SD) and counts (percentages).

Results

During the study period, 25 children (12 males and 13 females, mean age 8.66±3.34 years, body weight 31.88±15.41 kg) were referred for transcatheter ASD closure. Systolic pulmonary artery pressure was less than 30 mmHg in all patients. All procedures were performed under general anesthesia with the guidance of TEE. Anesthesia induction was performed with propofol and ketamine in 21 (84%) of patients. Thiopental was used as an anesthetic agent in the remaining 4 (16%) of the patients. Fentanyl was applied to all patients after anesthesia induction for intraoperative analgesia. None of the patients needed further fentanyl dosage during the procedure. In most patients (24/25), the selected non-depolarising muscle relaxant was rocuronium bromide.

We did not encounter any major complication related to the procedure or anesthesia. Transient bradycardia occurred in 2 patients, which was treated with atropine. None of the patients received blood transfusions. All patients were extubated in the operating room smoothly and the rest of the recovery period was uneventful.

Discussion

ASD causes left-to-right shunting which increases pulmonary arterial flow and pressure and, if left untreated, serious complications such as heart failure, failure to thrive, susceptibility to infections and even pulmonary hypertension, Eisenmenger syndrome and death. Patent foramen ovale can also lead these results so ASD must be closed [5]. Recent studies showed that the ideal age for ASD closure is 4-5 years old [6,7]. Although this procedure can be performed under deep sedation in adults, as it requires TEE guidance, general anesthesia with endotracheal intubation is required for the pediatric population. Hanslik et al. demonstrated in spontaneously breathing 197 pediatric patients (mean age 6.1 years) that transcatheter ASD closure can be accomplished with deep sedation by using ketamine and propofol with high success and low complication rates[4]. Although it was indicated that there was not encountered any problem related to the airway in this study, it should be keep in mind that airway collapse may easily happen in the pediatric population. Therefore, if there was no specific indication, the uses of general anesthesia offer better hemodynamic control as

well as more secure airway management for percutaneous ASD closure procedure in pediatric population. In our institute, TEE-guided transcatheter ASD closure is performed under general anesthesia in pediatric patients as our clinic protocol.

Whether general anesthesia or deep sedation is preferred, particular attention should be given to the hemodynamic effects of the drugs used. Although propofol, with its short duration of action, is the most commonly preferred anesthetic agent in such procedures, cardiac depressant effects should be considered. Ketamine is commonly combined with propofol; however, its prolonged recovery time limits its utility. Koruk et al.[8] compared propofol/dexmedetomidine and propofol/ketamine combinations in pediatric patients undergoing transcatheter ASD closure with general anesthesia and they indicated that both drug combinations had similar results except increased heart rates in the ketamine group and decreased recovery time in the dexmedetomidine group. Beside this, another study which compared combinations of propofol/ketamin and dexmedetomidine/ketamine showed that propofol plus ketamine group was superior to the other combination because it provided more effective analgesia with shorter recovery times[9].

In our practice, we prefer ketamine because of the lower risk of hypotension and bradycardia associated with its usage. We overcome the problem of longer recovery time of ketamine by avoiding repeated doses and using ketamine only during induction. We also infiltrate the puncture site with local anesthetics so that the patients do not feel pain and require further analgesics and anesthetics during the procedure.

Although it is a relatively safe procedure, transcatheter ASD closure can be associated with major complications including cardiac tamponade, stroke, thrombosis, bleeding and minor complications like arrhythmia[10]. Arrhythmias are usually transient and self-limiting, but rarely medical treatment or defibrillation may be required. In our study, transient bradycardia was encountered in 2 patients and treated with atropine. All patients were warmed with air blanket since hypothermia may induce arrhythmias, especially in the pediatric population.

An ideal anesthesia method and anesthetic drug combination for pediatric cardiac catheterization procedures is still controversial. But it is clear that regardless of the method of anesthesia, the anesthesiologist should take precautions against possible complications and the patient's hemodynamic stability must be closely followed.

Competing interests

The authors declare that they have no competing interests.

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